

WHAT IS CLAIMED IS:

- 1 1. A method of topographically mapping a surface, comprising:
2 directing a radiation beam toward a target location on the surface;
3 capturing an image of a beam spot at a location in an image plane
4 intersecting at least a portion of the radiation beam reflected from the target
5 location on the surface;
6 identifying at least one image plane coordinate for a peripheral point of the
7 beam spot image; and
8 assigning a relative height value to the target location based on a mapping
9 of the at least one image plane coordinate identified for the peripheral beam spot
10 point to the relative height value.
- 1 2. The method of claim 1, wherein the radiation beam is directed along
2 a beam axis and an image plane coordinate is identified with respect to a first
3 direction substantially parallel to a projection of the beam axis onto the image
4 plane.
- 1 3. The method of claim 2, wherein the peripheral point is located at a
2 peripheral area of the beam spot closer to the beam axis than other comparable
3 peripheral areas of the beam spot.
- 1 4. The method of claim 1, wherein identifying the at least one image
2 plane coordinate comprises applying a threshold to pixel values of the beam spot
3 image.
- 1 5. The method of claim 4, wherein a normalized grayscale threshold is
2 applied to the pixel values of the beam spot image.
- 1 6. The method of claim 1, wherein assigning a relative height value to
2 the target location comprises mapping the at least one image plane coordinate to a
3 predetermined relative height value.
- 1 7. The method of claim 6, wherein the at least one image plane
2 coordinate is mapped to the predetermined relative height value based on a
3 lookup table.

1 8. The method of claim 1, wherein the surface forms a boundary of a
2 substrate and is semitransparent with respect to the radiation beam.

1 9. The method of claim 8, wherein the substrate is a printed circuit
2 board.

1 10. The method of claim 9, further comprising repeating the steps of
2 directing, capturing, identifying, and assigning for a plurality of target location on
3 the surface of the printed circuit board arranged in a prescribed triangular mesh
4 pattern.

1 11. A system for topographically mapping a surface, comprising:
2 a radiation source oriented to direct a radiation beam toward a target
3 location on the surface;
4 an imager oriented to capture an image of a beam spot at a location in an
5 image plane intersecting at least a portion of the radiation beam reflected from the
6 target location on the surface;
7 a mapping engine operable to identify at least one image plane coordinate
8 for a peripheral point of the beam spot image, and to assign a relative height
9 value to the target location based on a mapping of the at least one image plane
10 coordinate identified for the peripheral beam spot point to the relative height
11 value.

1 12. The system of claim 11, wherein the radiation source is oriented to
2 direct the radiation beam along a beam axis, and the mapping engine is operable
3 to identify an image plane coordinate with respect to a first direction substantially
4 parallel to a projection of the beam axis onto the image plane.

1 13. The system of claim 12, wherein the peripheral beam spot point is
2 located at a peripheral area of the beam spot closer to the beam axis than other
3 comparable peripheral areas of the beam spot.

1 14. The system of claim 11, wherein the mapping engine is operable to
2 identify the image plane coordinates by applying a threshold to pixel values of the
3 beam spot image.

1 15. The system of claim 14, wherein the mapping engine is operable to
2 apply a normalized grayscale threshold to the pixel values of the beam spot
3 image.

1 16. The system of claim 11, wherein the mapping engine is operable to
2 assign a relative height value to the target location by mapping the at least one
3 image plane coordinate to a predetermined relative height value.

1 17. The system of claim 16, wherein the mapping engine is operable to
2 map the at least one image plane coordinate to the predetermined relative height
3 value based on a lookup table.

1 18. A computer program for topographically mapping a surface, the
2 computer program residing on a computer-readable medium and comprising
3 computer-readable instructions for causing a computer to:
4 identify at least one image plane coordinate for a peripheral point of a
5 beam spot image captured at an image plane intersecting at least a portion of
6 radiation beam reflected from a target location on the surface, and
7 assign a relative height value to the target location based on a mapping of
8 the at least one image plane coordinate identified for the peripheral beam spot
9 point to the relative height value.

1 19. The computer program of claim 18, wherein an image plane
2 coordinate is identified with respect to a first direction substantially parallel to a
3 projection onto the image plane of a beam axis of a radiation beam directed
4 toward the target location, and the peripheral beam spot point is located at a
5 peripheral area of the beam spot closer to the beam axis than other comparable
6 peripheral areas of the beam spot.

1 20. The computer program of claim 18, wherein the at least one image
2 plane coordinate is identified by applying a threshold to pixel values of the beam
3 spot image.